The Unconventional Stellar Aspect (USA) Experiment

The Unconventional Stellar Aspect (USA) Experiment, developed by the Naval Research Laboratory, is one of nine payloads aboard the Advanced Research and Global Observation Satellite (ARGOS) which launched on February 23, 1999. USA is a proportional counter X-ray timing experiment which operated until November 16, 2000 when the last of the detectors ran out of gas. USA carried out a broad research program designed for the dual purpose of making high time-resolution observations of cosmic X-ray sources and exploring applications of X-ray sensor technology in orbit. The key features of the hardware are dual proportional counters each with an effective collecting area of 1000 cm^2 with energy response extending from 1 to 15 keV, high time resolution (up to 2 μs) and excellent absolute timing accuracy achieved using a GPS receiver onboard the ARGOS spacecraft.

The USA scientific program made use of the flexible scheduling of the experiment to accumulate large exposures of a relatively small number of bright X-ray sources, predominately black holes and neutron stars. These sources provide excellent laboratories for investigating the physics of matter in extreme conditions such as strong gravitational fields, high temperatures, high magnetic fields, and relativistic bulk motions. Several transient black hole binary systems were studied in detail with multiple daily observations covering outbursts that last for months. Significant time was also allocated to studies of bright accreting neutron stars, flaring active galactic nuclei (AGN), and X-ray pulsars. Papers illustrating results may be found at the web site below.

The USA applied research program emphasizes the use of X-ray detectors for providing autonomous timekeeping and navigational capabilities as well as studying the neutral density profile of the Earth's upper atmosphere. These objectives are fulfilled simultaneously with the science program by using X-ray binaries and pulsars as celestial clocks and observing many horizon crossings of bright X-ray sources. In addition, two computers were flown side-by-side in the USA central electronics box. One was an expensive radiation-hardened Harris RH3000 while the other was a commercial off-the-shelf (COTS) IDT3081 processor running fault-tolerant software algorithms. This experiment demonstrated the feasibility of using COTS components in space and showed that they can attain high reliability and far better price-to-performance than special purpose radiation-hardened parts.

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